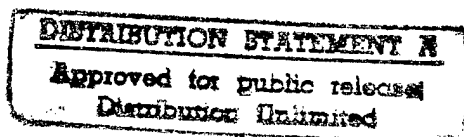

Logistics Management Institute

Data Supporting the Screening Risk
Assessment for the Pueblo
Depot Activity Chemical
Demilitarization Facility

CE417RD3

DTIC QUALITY INSPECTED 8

William E. Legg



19960823 067

LMI

August 1995

Data Supporting the Screening Risk Assessment for the Pueblo Depot Activity Chemical Demilitarization Facility

CE417RD3

William E. Legg

Prepared pursuant to U.S. Army Corps of Engineers Contract DACW31-94-D-0092. The views expressed here are those of the Logistics Management Institute at the time of issue but not necessarily those of the U.S. Army Corps of Engineers. Permission to quote or reproduce any part except for government purposes must be obtained from the Logistics Management Institute.

Logistics Management Institute
2000 Corporate Ridge
McLean, Virginia 22102-7805

Contents

Study Objectives	1
Introduction	1
Background	1
Risk Assessment Requirements	2
Screening-Level Risk Analysis Data Requirements	3
Data Collection Methods	4
Conclusions	5
Findings	5
Sample Screening-Level Risk Analysis Calculations	5
Inhalation Chronic Daily Intake Adult Resident	5
Linear Low-Dose Cancer Risk	6
Noncancer Hazard Quotient	6
Data Element Requirements	7
Phase I	7
Phase II	9
Results	11
Screening Data Parameters	11
Phases I and II Exposure Assessment Parameters and Data	
Values	12
Body Weight Ranges	12
Monthly Average Air Temperature and Storm Event	
Data	12
Sustained Average Wind Speed and Direction;	
Threshold Wind Speed	13
Hunting and Fishing Data	13
Types of Produce Grown in Home Gardens	14
Types of Recreation by County	14
Soils Data	15
Vegetative Cover	15
Erosion Data	15

Contents (Continued)

Plant Tissue	15
Animal Products	18
Breast Milk	18
Percentage of Grain and Silage Grown within the Study Area Versus Imported	19
Ratio of Grain and Silage Grown within the Study Area Used to Feed Livestock Versus Imported Grain and Silage	19
Ratio of Grain Grown within the Study Area Fed to Chickens Versus Imported Grain	19
Amount of Soil in Grain and Silage	19
Ratio of Livestock Raised in the Study Area That is Consumed	19
Other	19
Recommendations	20
Bibliography	21
Appendix. Data Tables	

Data Supporting the Screening Risk Assessment for the Pueblo Depot Activity Chemical Demilitarization Facility

STUDY OBJECTIVES

The objectives of this study were to develop data element requirements and collection methods, collect the Phase I screening information and demographic information, analyze the Phase I data, make recommendations as to the use of the U.S. Environmental Protection Agency (USEPA) default values or derive appropriate default values for use.

INTRODUCTION

Background

The Pueblo Depot Activity Chemical Demilitarization Facility is located in Pueblo County, Colorado, about 100 miles southeast of Denver and 14 miles east of Pueblo; the Arkansas River is approximately one mile south of the activity. The facility encompasses 22,654 acres and is situated on flat to gently sloped prairie. The surrounding lands are mostly undeveloped ranchlands used for grazing, with some light commercial and residential zoned areas to the south.

The Pueblo Depot Activity was established by the Ordnance Corps in 1942 as Pueblo Army Depot with the missions of storage and supply of ammunition and general supplies during World War II. After World War II the depot received the additional missions of rebuilding and maintaining artillery fire control and optical materials; reconditioning transport and combat vehicles; ammunition supply, renovation, and demilitarization; chemical and conventional munitions storage; and maintenance of Sergeant, Pershing, and Nike missiles. The depot is one of eight sites that stores lethal unitary agents in the United States. The missile maintenance mission continued until 1974 when realignment transferred most of those activities to Letterkenny Army Depot in Pennsylvania. At that time, the depot was redesignated as Pueblo Depot Activity; responsibility for the activity was reassigned to Tooele Army Depot in Utah. The activity was recommended for realignment by the Defense Secretary's Commission on Base Realignment and Closure in its December 1988 report.

In 1986, the Department of Defense Authorization Act was promulgated. It directed the destruction of the chemical agent munitions stockpiles by 30 September 1994. This act was amended in 1988 to allow for operational testing of a commercial-scale incineration project and the date for complete destruction of the stockpiles was extended to September 1997. Based upon the results of an environmental impact statement, the chemical agent disposal method that appeared to provide the highest degree of safety and protection of human health and the environment was the on-site, high-temperature incineration method. Thus, the chemical agent demilitarization program initiated the design of the incineration facilities and preparation of the required Resource Conservation and Recovery Act (RCRA) Part B permits for the hazardous waste incinerators.

In 1993, the U.S. Army Center for Health Promotion and Preventive Medicine, Provisional [USACHPPM(P)] was tasked by the U.S. Army Chemical Demilitarization and Remediation Activity (USACDRA) to perform multipathway human health risk assessments (HHRA) and ecological risk assessments (ERA) for the eight sites that store unitary chemical agents. The Logistics Management Institute (LMI) was requested to develop the screening-level risk analysis (SRA) data requirements for the Pueblo Depot Activity (PUDA) proposed site.

Risk Assessment Requirements

The USEPA requires all RCRA Part B permit applications for hazardous waste incinerators to include a risk assessment (RA) that contains a multipathway HHRA and an ERA. Pursuant to the USEPA guidance, the RA uses a staged protocol that starts with a conservative SRA. The SRA is intended to provide the most conservative estimate of the potential risk, carcinogenic and noncarcinogenic, from direct exposures to combustion emissions and indirect exposures to contaminated soils, water sources, and food products. The SRA endpoints are estimates of individual risk for four specific exposure scenarios: a subsistence farmer, a subsistence fisher, an adult resident, and a child resident. For each scenario, the risk estimates are based on combining exposures and resultant risk for an individual contaminant of concern across several pathways. Where appropriate, risk from multiple contaminants of concern are also combined to provide overall estimates of risk for each exposure scenario. In the SRA for PUDA, 83 contaminants are of concern for which risk estimates must be calculated. The USEPA screening guidance also provides default values for most of the input parameters used in the SRA calculations; but allows the use of validated site-specific data to modify the values for the input parameters, especially in the situation where default values would constitute implausible scenarios. The USEPA's levels of acceptable risk for an SRA are as follows:

- ◆ One per 100,000 population exposed ($1E-5$), plausible upper-bound estimate of the probability of an individual developing cancer as a result of a lifetime of exposure (70 years) to the modeled levels of carcinogenic emissions from the PUDA hazardous waste incinerator. The modeled levels are based on trial burn emissions measurements taken at the Johnston Atoll chemical agent demilitarization facility.

- ◆ For noncarcinogenic systemic toxicants, the hazard quotient (HQ) (e.g., the ratio of the total daily oral intake to an established reference dose) for the contaminant of concern or, when appropriate, the hazard index (HI) (e.g., the sum of the HQs of contaminants in a mixture) should be less than 0.25. When HQs or HIs exceed unity (i.e., 1.0), there may be concern for potential adverse health effects.

Normally, the USEPA's acceptable level of carcinogenic risk is described as a risk range of one per 10,000 ($1E-4$) to one per 1,000,000 ($1E-6$) and the noncarcinogenic risk is any HQ or HI that does not exceed unity (i.e., 1.0). The levels proscribed for hazardous waste incinerator SRAs take into account that the unit may not be the only source contributing to exposures in the study area. Background exposure sources must be considered in order to avoid overestimation of allowable emissions levels, which could lead to unacceptable health risks to the public.

If the SRA results meet the acceptable risk criteria, then there is reason to conclude that further analysis of the risk from stack emissions is unnecessary. If the SRA results do not meet acceptable risk criteria, then phased demographic-specific (up to six levels) risk analyses must be completed. The phased risk analyses build increasing specificity into site data requirements only to the level required to verify compliance with the acceptable risk criteria. If none of the phased demographic-specific risk analyses meet the acceptable risk criteria, then the facility is denied the RCRA Part B permit.

Screening-Level Risk Analysis Data Requirements

The SRA algorithms use a combination of USEPA default data values and site-specific data values. The USEPA default values are used in the air dispersion and contaminant deposition modeling; calculating media concentrations for each of the exposure pathways associated with indirect exposures; and determining fate, transport, and uptake parameters for specific chemicals of concern. The site-specific data collection and evaluation focuses on hydrogeological, topographical/terrain, meteorological, facility operational, emissions, and exposure assessment data. The site-specific data is confined to an area encompassed by a 50 kilometer radiused circle about the operational facility. The USEPA requires that all default and site-specific data developed for use in an SRA be validated and referenced. The USEPA reserves the authority to dismiss any data values that it believes will lead to inappropriate estimates of risk. USACHPPM(P) and LMI personnel developed the data element requirements on the basis of a review of all USEPA guidance documents and their professional expertise in the risk assessment arena.

The screening-level data parameters primarily focus on the potential for indirect exposures to emissions from combustion sources; however, they directly relate to the amount of stack emissions that may be entrained in ambient air and, thus, is available for human/animal inhalation and human dermal absorption exposures. Their primary use is for the determination of fate and transport plus

wet and dry deposition of the emissions products into surface waters, onto soils, and onto standing crops that constitute an indirect human/animal exposure pathway from the food chain.

Again, four human exposure scenarios are used in the SRA: a subsistence farmer, a subsistence fisher, an adult resident, and a child resident. These exposure scenarios differ primarily in the consumption rates of contaminated foods.

In the subsistence farmer exposure scenario, the farmer is exposed by consumption of homegrown beef, milk, and vegetables; incidental ingestion of soil; and direct inhalation of vapors and particulates. Site-specific exposure parameters and data should be used, where possible, to modify the basic default values and exposure scenarios in the effort to avoid unrealistic risk outcomes.

The subsistence fisher is exposed by consumption of contaminated fish, homegrown vegetables, incidental ingestion of soil, and direct inhalation of vapors and particulates. Site-specific fish consumption patterns should be used to avoid being overly conservative in this exposure scenario. The uptake of contaminants by above-ground and root vegetables is an especially critical element of both of the subsistence scenarios.

For both the adult and child resident scenarios, the exposures are consumption of homegrown vegetables, incidental soil ingestion, and the direct inhalation of vapors and particulates. The exposure parameters must be chosen carefully in the child resident exposure scenario because the toxicity potential of the emissions products exert their effects during a 6-year exposure period rather than the 40-year exposure period used in the subsistence farmer scenario and the 30-year exposure period used in the subsistence fisher and adult resident scenarios.

Data Collection Methods

The data were collected by reviewing numerous data sources and contacting specific Colorado State, County, and municipal offices. Personnel contacted for the various data elements are listed with the applicable section of data. The list of data elements required was developed from the USEPA's *Methodology for Assessing Health Risks Associated with Indirect Exposure to Combustor Emissions*, and its 1993a addendum; the *Revised Draft of Risk Assessment Implementation Guidance for Hazardous Waste Combustion Facilities*, USEPA 1994a; and the *Draft Guidance for Performing Screening Level Risk Analyses at Combustion Facilities Burning Hazardous Wastes*, with all addendums such as USEPA 1994b, 1994c, 1994d, 1994e, and 1994f. We also developed a tabular array of the required data elements to facilitate data collection and to assist in data presentation (see Appendix).

CONCLUSIONS

The data presented in this report and the data provided under separate cover were validated with local, state, and Federal personnel for accuracy and representative of the PUDA area of concern.

FINDINGS

Sample Screening Level Risk Analysis Calculations

We are providing a very simplified version of the risk assessment calculations found in a typical SRA. In the examples, we use one of the semi-volatile contaminants of concern, tetrachlorodibenzo-(p)-dioxin (TCDD). We are also using the modeled exposure concentrations for TCDD as they were calculated for the SRA at PUDA.

INHALATION CHRONIC DAILY INTAKE ADULT RESIDENT

The chronic daily intake (CDI) is computed only for use in the linear low-dose cancer risk equation.

$$CDI(mg/kg-day) = \frac{CA \times CF \times IR \times ET \times EF \times E}{BW \times AT}$$

where

- CA = contaminant concentration in air in milligrams per meter cubed of air (mg/m^3) = $1.77E-11$ microgram (ug)/ m^3 TCDD computed from the USEPA air model; this value is also used as the exposure intake value (E) in the noncancer HQ formula;
- CF = conversion factor from ug/m^3 to mg/m^3 = $1\ mg/1,000\ ug$;
- IR = inhalation rate [m^3 /hour (hr)] = $1\ m^3/hr$ for an adult resident (i.e., the USEPA default value);
- ET = exposure time [hr/day (d)] = $24\ hr/d$ (i.e., USEPA default value);
- EF = exposure frequency [d/year (yr)] = $350\ d/yr$ (i.e., USEPA default value);
- ED = exposure duration (yr) = $30\ yr$ (i.e., USEPA default value);
- BW = body weight in kilograms (kg) = $70\ kg$ (i.e., USEPA default value); and

AT = averaging time (days) = 70-year lifetime for toxic effects (i.e.,
70 yr × 365 d/yr) = 25,550 days.

$$CDI(mg/kgd) = \frac{(1.77E-11 ug/m^3)(1mg/1,000 ug)(1m^3/hr)(24 hr/d)(350 d/yr)(30 yr)}{(70 kg)(25,550 d)}$$

$$CDI(mg/kgd) = \frac{(1.77E14 mg)(2.52E+05)}{(1.7885E+06 kgd)}$$

$$CDI = 2.49E15 (mg/kgd)$$

LINEAR LOW-DOSE CANCER RISK

$$Risk = CDI \times SF,$$

where

CDI = chronic daily intake averaged more than 70 years (mg/kg-d);

SF = inhalation cancer slope factor of TCDD = 1.16E+05 (mg/kg-d)⁻¹;
and

Risk = 2.49E-15 (mg/kg-d) × 1.16E+05 (mg/kg-d)⁻¹ = 2.89E-10. Conventionally, this number is rounded to the nearest whole number after completing the calculation. Therefore, the excess cancer risk due to emissions of TCDD = 3.0E-10 or three excess cancers per 10 billion persons exposed over a lifetime to this concentration of TCDD.

NONCANCER HAZARD QUOTIENT

The noncancer hazard quotient assumes that there is a level of exposure [i.e., reference dose (RfD) for oral exposures and reference concentration (RfC) for inhalation exposures] below which it is unlikely for even sensitive populations to experience adverse health effects. If *E* exceeds this threshold (i.e., *E*/RfD or *E*/RfC exceeds unity), there may be concern for potential noncancer toxicity effects.

$$Noncancer HQ = E/RfC,$$

where

E = exposure level = 1.77E-11ug/m³ as modeled for TCDD;

RfC = 3.50E-06 ug/m³ for TCDD, from the Integrated Risk Information System (IRIS). (This RfC for TCDD has been deleted from IRIS

and is under review. It is used for example calculation purposes only.); and

$$HQ = 1.77\text{E-}11 \text{ ug/m}^3 / 3.50\text{E-}6 \text{ ug/m}^3 = 5.06\text{E-}6 \text{ or } 0.00000506$$

Data Element Requirements

The data element requirements list developed for use in the SRA for the PUDA is as follows:

PHASE I

Screening Data Elements

- ◆ Facility operational time period
- ◆ Average annual precipitation
- ◆ Average annual irrigation
- ◆ Average annual evapotranspiration
- ◆ Average annual surface runoff
- ◆ Universal soil loss equation rainfall or erosivity factor
- ◆ Total area for each body of water
- ◆ Impervious watershed area receiving deposition
- ◆ Total watershed area receiving deposition
- ◆ Average volumetric flow rate
- ◆ Depth of water column for each body of water.

Exposure Assessment Data Elements

- ◆ General
 - ▶ Site-specific body weight range
 - ▶ Monthly average air temperature
 - ▶ Sustained average wind speed, threshold wind speed

- ▶ Types of produce grown in home gardens
- ▶ Storm duration and length of time since previous rainfall
- ▶ Number of people who fish and/or hunt
- ▶ Types of recreation: swimming, golfing, hiking, camping, biking, and all-terrain vehicular activities.
- ◆ Soil
 - ▶ Plow depth
 - ▶ Soil types: soil texture, bulk density, organic content percentage, field capacity, and wilting point
 - ▶ Unit soil loss: rainfall index, soil erodibility index, length-slope factor, support practice factor, and management practice factor
 - ▶ Fraction of vegetative cover for each land use.
- ◆ Plant tissue
 - ▶ Crop-specific information: crop productivity, harvest yield of the crop, and area planted to crop
 - ▶ Leafy vegetables: height of plant from the ground, radius of plants, number of plants per row, number of rows of plants, distance between plants in a row, and distance between rows of plants
 - ▶ Round and long produce: number of produce per unit area, radius of produce, length of long produce, and length and width of unit area
 - ▶ Fruits: number of fruits per unit area, length of long fruit, and radius of round fruit
 - ▶ Length of growing season for each crop and produce item
 - ▶ Human daily ingestion of each produce group: leafy vegetables, above-ground protected produce, above-ground exposed round produce, above-ground exposed long produce, and below-ground produce.
- ◆ Animal tissue
 - ▶ Types of livestock: beef cattle, dairy cattle, pigs, sheep/goats, and chickens
 - ▶ Game animals that are consumed.

- ◆ Nursing infants
 - ▶ Number and location of breast-feeding mothers
 - ▶ Number of infants born per year.

PHASE II

The data is used in the conduct of additional, more specific site health risk assessments, if the SRA fails to meet the USEPA screening criteria. The following data elements will be used in the more specific risk assessments. The data has been provided to the USACHPPM(P) under separate cover. This data can be summarized and presented in database format when and if it is required.

- ◆ General
 - ▶ Population centers: locations and numbers
 - ▶ Locations of schools, nursing homes, and hospitals
 - ▶ Major employers and locations
 - ▶ Work schedule for employees within study area
 - ▶ Exposure duration for civilian and military residents
 - ▶ Current census information.
- ◆ Plant tissue
 - ▶ Number and location of crop farms, truck patch farms, and orchards; also types of produce grown
 - ▶ Ratio of produce grown within study area that is consumed versus exported
 - ▶ Source and location of irrigation water for farms and home gardens
 - ▶ Location of home gardens.
- ◆ Animal tissue
 - ▶ Locations and numbers of livestock farms
 - ▶ Numbers of livestock at each farm
 - ▶ Livestock water source

- ▶ Percentage of grain and silage grown within study area versus the amount imported
- ▶ Ratio of grain and silage grown within study area used to feed livestock versus imported grain and silage
- ▶ Ratio of grain grown within study area fed to chickens versus amount of imported grain
- ▶ Amount of soil in grain and silage
- ▶ Average daily ingestion rate of grain, silage, and forage of each animal group
- ▶ Percentage of livestock that is consumed
- ▶ Ratio of livestock raised in the study area that is consumed versus imported
- ▶ Human daily ingestion rate of each animal group
- ▶ Human daily ingestion rate of each game animal
- ▶ Body fat percentage for each game animal.
- ◆ Surface water
 - ▶ Location, type, and use of body of water
 - ▶ Watershed delineation
 - ▶ Irrigation ditches: flow, average depth, and surface area
 - ▶ Percentage of stagnant surface water
 - ▶ Percentage of running surface water
 - ▶ Drinking water sources.
- ◆ Recreational
 - ▶ Locations of commercial and recreational fishing areas
 - ▶ Human daily ingestion rate of fish from area
 - ▶ Number of fish farms
 - ▶ Number of people who fish: subsistence and recreational fishers

- ▶ Number of people who hunt and/or fish
- ▶ Hunting location for each game animal
- ▶ Recreation locations, recreation frequency, and recreation exposure time.

RESULTS

This section provides the data documentation for the SRA. On the basis of the data collected and analyzed, we believe the values presented here and in the Appendix should be used in the SRA for PUDA.

Screening Data Elements

- ◆ Facility operational time period (USEPA default is 24 hours/day for a 30-year time period).
- ◆ Average annual precipitation (**P**) = 28.0 cm/yr (from the Preliminary Draft Environmental Impact Statement Analysis, p. 3-7, USACDRA, February 1994).
- ◆ Average annual irrigation (**I**) = 36.1 cm/yr (from the U.S. Department of Agriculture, Soil Conservation Service and the National Oceanic and Atmospheric Administration Technical Report NWS 33).
- ◆ Average annual evapotranspiration (**Ev**) \leq 60.96 cm/yr (Geraghty *et al.*, *Water Atlas of the United States*, 1994).
- ◆ Average annual surface runoff (**R**) = 1.27 cm/yr (Geraghty *et al.*, *Water Atlas of the United States*, 1994).
- ◆ Universal soil loss equation erosivity factor (**RF**) = 70 1/yr (averaged from the R values of the five counties of concern).
- ◆ Total surface area for each major body of water:
 - ▶ Pueblo Reservoir (**WA_w**) = $2.30\text{E} + 07 \text{ m}^2$ (based upon information provided by Linda Hopkins, Colorado Bureau of Reclamation, May 1995).
 - ▶ Arkansas River (minus Pueblo reservoir) (**WA_w**) = $4.11\text{E} + 06 \text{ m}^2$ (computed based upon information provided by Ron Steiger, USGS, May 1995).
 - ▶ State Fish Hatchery, due southeast of Pueblo Reservoir (**WA_w**) = $1.04\text{E} + 05 \text{ m}^2$ for 32 rearing ponds; $4.0\text{E} + 03 \text{ m}^2$ for 32 trout raceways

(computed based upon information provided by Tom Kingsley, hatchery supervisor, May 1995).

- ◆ Impervious watershed area receiving deposition (WA_i) = $1.56E + 09 \text{ m}^2$ (USACDRA, 1994).
- ◆ Total watershed area receiving deposition (WA_t) = $7.90E + 09 \text{ m}^2$, which is the area of a 50 kilometer circle as required by the SRA.
- ◆ Average volumetric flow rate:
 - ▶ Pueblo Reservoir (V_{fx}) = $6.43E + 08 \text{ m}^3/\text{yr}$ (computed from data of hydrologic station 07099400, Arkansas River above Pueblo, an average of 18 years worth of data).
 - ▶ Arkansas River (V_{fx}) = $7.63E + 08 \text{ m}^3/\text{yr}$ (computed from data of hydrologic station 07119700, Arkansas River at Catlin Dam near Fowler, Colorado, an average of 18 years worth of data).
 - ▶ State Fish Hatchery (V_{fx}) = $2.39E + 04 \text{ m}^3/\text{yr}$ (for the rearing ponds), $2.13E + 07 \text{ m}^3/\text{yr}$ (for the trout raceways computed based upon information provided by Tom Kingsley, hatchery supervisor, May 1995).
- ◆ Depth of water column for each body of water:
 - ▶ Pueblo Reservoir (d_w) = 27.99 m at maximum capacity (data provided by Steve Williams, Dam Office, Pueblo Reservoir, May 1995).
 - ▶ Arkansas River (d_w) = 1.324 m (data provided by Ron Steiger, USGS, May 1995).
 - ▶ State Fish Hatchery (d_w) = 1.45 m for the rearing ponds, 0.91 m for the trout raceways (data provided by Tom Kingsley, hatchery supervisor, May 1995).

Phases I and II Exposure Assessment Data Elements and Data Values

BODY WEIGHT RANGES

Children ages 1 to 6, 15 kg; adults, 70 kg; infants, age <1 year, <11 kg. Data extracted from USEPA's *Exposure Factors Handbook* (EFH), risk-assistant exposure-assessment scenarios background defaults. Data is used in exposure uptake formulas and in Phase II to identify risk-based subpopulations.

MONTHLY AVERAGE AIR TEMPERATURE AND STORM EVENT DATA

Data was provided to the USACHPPM(P) under separate cover from the National Climatic Data Center, Climate Services Division (based upon the Pueblo Memorial Airport data station): 1993 data plus analyses for average air temperature, average storm event, maximum storm event, and average time between storm events. Data is used in primary plume modeling: soils uptake, crop uptake of contaminants, soil erosion and runoff to surface waters, and body of water contamination formulas.

SUSTAINED AVERAGE WIND SPEED AND DIRECTION; THRESHOLD WIND SPEED

Data was extracted from environmental impact statement (EIS) analysis completed by USACDRA, February 1994. Data is used in primary plume modeling.

HUNTING AND FISHING DATA

Data was provided under separate cover.

Hunting

Hunting data summary is provided by the Colorado Department of Natural Resources, Division of Wildlife, Ann Seiler, Deputy Director and Bill Devenny of their Economic Analysis Branch. The hunting harvest and exposure days data was extracted from the *Colorado Big Game Harvest 1993*, report; and, the license information was extracted from Tables 1 through 38 of the *Colorado Division of Wildlife Economic Impact Model*. Based upon EFH average consumption values of 100 grams/meal \times 4 persons eating/meal (400 grams/meal/family of four), a total meals eaten (T)/species of big game at the 100 grams/person/meal rate, T_{100} was computed. Likewise, a T_{280} was computed for the reasonable maximum exposure (RME) consumption rate of 280 grams/meal \times 4 persons eating/meal (1,120 grams/meal/family of four). In addition, fraction contaminated (FC_{100} , FC_{280}) values, which are the ratios of all contaminated meals consumed to the total meat meals consumed in a 350-day exposure year based upon the two consumption rates, were computed for each species of big game. Any FC value ≥ 0.75 (the USEPA default value) might be equated with subsistence hunting. Based upon the numbers of small game bagged per hunter, the average ingestion quantities of all small game meat does not appear to add any significant risk to the small game hunters and their families. The $T_{100} = 9.7$ meals/yr and the $T_{280} = 3.5$ meals/yr. These figures for small game ingestion indicate that the T_{100} would represent 0.009 percent of the total meals eaten during the exposure period and the T_{280} would represent 0.003 percent of the total meals for the same exposure period.

Colorado hunting is so well controlled that it is virtually impossible to be a licensed subsistence hunter within the boundaries of the game laws and regulations. Subsistence hunting may be allowed on Native American lands; but, no such areas exist in the area of interest around Pueblo, Colorado. However, there are certain instances where the licensed hunter could be so successful in the harvesting of big game animals, that a family of four could exist on the game meat. For example, the potential exists that 156 elk hunters who shot bull elk could have also shot a buck mule deer and a buck antelope. Adding the FC_{100s} for the animals results in a combined $FC_{100} = 1.46$ which is greater than the USEPA default value of 0.75. It is obvious from the data that all successful elk hunters (328) who were also successful in harvesting mule deer and antelope could be classed as subsistence hunters at the T_{100} consumption rate for a family of four. We therefore recommend use of the USEPA default FC values of 0.44 for average consumption and 0.75 for RME consumption if this exposure scenario is used.

Fishing

The fishing data summary is provided by the Colorado Department of Natural Resources, Division of Wildlife, Fisheries Branch. Consumption data was derived from data Mr. Krieger provided on Pueblo Reservoir, the Arkansas River basin, and Runyon and Fountain lakes within the 50-kilometer zone. The majority of fish harvested are rainbow trout (average fat content of 4.5 percent); the remainder of fish harvested are comprised of Bluegill Sunfish, Black Bullhead Catfish, Channel Catfish, Carp, Crappie, Large Mouth Bass, Small Mouth Bass, Saugeye, Walleye, White Sucker, and Yellow Perch (average fat content for these species is 2.35 percent). If the average fisherman fished all of these waters and harvested the average number of fish, the total intake/exposure day/year would = 40.27 grams. The average intake for the fisherman would be 10.06 grams/exposure day/year. These figures are for one person's exposure, not a family of four. It is clear that subsistence fishing is not occurring in this exposure area based upon the harvest data.

TYPES OF PRODUCE GROWN IN HOME GARDENS

The default list was provided. For ingestion rates, LMI recommends using *EFH* default values listed in Tables 2-6, 2-7, 2-9, and 2-10 of the *EFH*. This method allows use of the Colorado Census Data to derive the number of gardens per county using the *EFH* default of 53 percent for the west. Several exposure uptake and scenarios which use this information for calculating residual risk.

TYPES OF RECREATION BY COUNTY

The data was obtained from the EIS and the Colorado Division of Parks and Outdoor Recreation. The data for the risk assessment mainly pertains to fishing and hunting; but, they also include inhalation exposures, and dermal exposures while swimming. Data were provided on the basis of the number of user

days/annum/park within the study area. With the use of the default data for recreation found in Tables 5-5 through 5-9 of the *EFH*, exposure durations for the swimming events may be calculated for the various age groups and exposure scenarios. The hunting and fishing days for exposure were provided from the sources noted in the hunting and fishing data above.

SOILS DATA

Soils data books for each county within the 50 kilometer radiused circle were obtained from the Colorado Soil and Water Conservation Department. Summaries of the physical and chemical properties of the soils within each county were also provided. The soils types for each county were analyzed for central tendency values for K values (erosion factor), Length-Slope values, Organic Matter percent, and Moist Bulk Density (using first soil layer only 1-20 centimeters, 0.4 - 8 inches). These values are used in formulas for wet and dry deposition of contaminants in soils; plant uptake of contaminants; and soils contamination of surface bodies of water. The EIS listed the affected region as being 1.03 percent forested, and 79.24 percent agricultural. The remaining 19.73 percent is comprised of built-up areas and miscellaneous. Each county lists its own figures for forest versus agricultural land, but the percentages will likely hover around the EIS data. LMI recommends that only the agricultural and pasture percentages be subjected to the crop contaminant portions of the risk assessment and the erosion equations. The forests are essentially protected crops and are not subject to high erosion potential or wet/dry deposition rates of the contaminants.

VEGETATIVE COVER

The data extracted from the EIS are as follows:

- ◆ Total area in 50-km radius = $7.90\text{E} + 09 \text{ m}^2$
- ◆ Forest = 1.03 percent = $8.14\text{E} + 07 \text{ m}^2$
- ◆ Agriculture = 79.24 percent = $6.26\text{E} + 09 \text{ m}^2$
- ◆ Other = 19.73 percent = $1.56\text{E} + 09 \text{ m}^2$

EROSION DATA

Discussed under the "Soils Data" subsection above.

PLANT TISSUE

The data were provided from the 1994 *Colorado Agricultural Statistics Report* (1992 – 1993), and from the EIS section on community resources. The major crops are listed by county along with the crop yields, number of producing farms, etc. The vapor transfer of contaminants to plant tissues seems to be a driver in the risk assessment. Therefore some of the planting practices data are required to calculate risks. The human daily ingestion data will use the default data from *EFH* Tables 2-6 through 2-10. The major agricultural plants for the study region are the following:

◆ Corn

- ▶ Plants/acre = 20,000
- ▶ Rows/acre = 83.5
- ▶ Plants/row = 239.5
- ▶ Height of plant = 6.5 ft
- ▶ Radius of plant = 1.5 ft
- ▶ Distance between plants = 10.44 in.
- ▶ Distance between rows = 2.5 ft
- ▶ Yield/acre = 134.57 bushels (bu) \times 25.4 kg/bu = 3418.1 kg/acre \div 4.047 m²/acre = 0.8446 kg/m²
- ▶ Length of growing season = 230 days

◆ Wheat

- ▶ Plants/acre = 1,558,746
- ▶ Rows/acre = 417
- ▶ Plants/row = 3,738
- ▶ Height of plant = 2.5 ft
- ▶ Radius of plant = 4.5 in.
- ▶ Distance between plants = 0.67 in.
- ▶ Distance between rows = 6.0 in.

- ▶ Yield/acre = $31.14 \text{ bu/a} \times 27.1 \text{ kg/bu} = 843.9 \text{ kg/a} \div 4.047 \text{ m}^2/\text{a} = 0.2085 \text{ m}^2/\text{a}$
- ▶ Length of growing season = 210 days
- ◆ Barley
 - ▶ Plants/acre = 385,770
 - ▶ Rows/acre = 385
 - ▶ Plants/row = 1,002
 - ▶ Height of plant = 3.0 ft
 - ▶ Radius of plant = 3.75 in.
 - ▶ Distance between plants = 2.5 in.
 - ▶ Distance between rows = 6.5 in.
 - ▶ Yield/acre = $55 \text{ bu/a} \times 18.1 \text{ kg/bu} = 995.5 \text{ kg/a} \div 4.047 \text{ m}^2/\text{a} = 0.2460 \text{ kg/m}^2$
 - ▶ Length of growing season = 190 days
- ◆ Sorghum
 - ▶ Plants/acre = 52,271
 - ▶ Rows/acre = 83.5
 - ▶ Plants/row = 626
 - ▶ Height of plant = 3.0 ft
 - ▶ Radius of plant = 1.5 ft
 - ▶ Distance between plants = 4 in.
 - ▶ Distance between rows = 2.5 ft
 - ▶ Yield/acre = $27.88 \text{ bu/a} \times 27.1 \text{ kg/bu} = 755.6 \text{ kg/a} \div 4.047 \text{ m}^2/\text{a} = 0.1876 \text{ kg/m}^2$
 - ▶ Length of growing season = 204 days

- ◆ Oats
 - ▶ Plants/acre = 385,770
 - ▶ Rows/acre = 385
 - ▶ Plants/row = 1,002
 - ▶ Height of plant = 3.0 ft
 - ▶ Radius of fruit = 3.75 in.
 - ▶ Distance between plants = 2.5 in.
 - ▶ Distance between rows = 6.5 in.
 - ▶ Yield/acre = $52 \text{ bu/a} \times 18.1 \text{ kg/bu} = 941.2 \text{ kg/a} \div 4.047 \text{ m}^2/\text{a} = 0.2326 \text{ kg/m}^2$
 - ▶ Length of growing season = 185 days
- ◆ Dry beans (mostly pinto beans)
 - ▶ Plants/acre = 34,853
 - ▶ Rows/acre = 83.5
 - ▶ Plants/row = 417.4
 - ▶ Height of plant = 2.0 ft
 - ▶ Radius of plant = 1.0 ft
 - ▶ Distance between plants = 6.0 in.
 - ▶ Distance between rows = 2.5 ft
 - ▶ Yield/acre = $749.8 \text{ kg/a} \div 4047 \text{ m}^2/\text{a} = 0.1853 \text{ kg/m}^2$
 - ▶ Length of growing season = 143 days.

ANIMAL PRODUCTS

The data were provided in an 1994 *Colorado Agricultural Statistics Report* (1992 – 1993), and the EIS section on community resources. The consumption factors from the *EFH* will be used to calculate average daily intake and lifetime average daily intake values. The data for the huntable species were derived by LMI. The USACHPPM(P) is advised to apply contaminant uptake

concentrations to game animals by calculating uptake rates for 1.03 percent forested areas + 79.24 percent agricultural areas to daily food intakes of the game animals.

BREAST MILK

The data were provided to USACHPPM(P) by the county on the birth rates for the last 10 years and the percentage of mothers who breast-fed their babies. These data were obtained from Colorado's Women, Infants, and Children program. The breast-milk contamination scenarios should be limited to an exposure duration of one year.

PERCENTAGE OF GRAIN AND SILAGE GROWN WITHIN THE STUDY AREA VERSUS IMPORTED

<i>Grown</i>	<i>Imported</i>
grain = 90 percent	grain = 10 percent
silage = 90 percent	silage = 10 percent

RATIO OF GRAIN AND SILAGE GROWN WITHIN THE STUDY AREA USED TO FEED LIVESTOCK VERSUS IMPORTED GRAIN AND SILAGE

<i>Grown and Fed</i>	<i>Imported and Fed</i>
grain = 90 percent	grain = 10 percent
silage = 90 percent	silage = 10 percent

RATIO OF GRAIN GROWN WITHIN THE STUDY AREA FED TO CHICKENS VERSUS IMPORTED GRAIN

<i>Grown and Fed</i>	<i>Imported and Fed</i>
grain = 10 percent	grain = 90 percent

AMOUNT OF SOIL IN GRAIN AND SILAGE

Zero percent for both.

RATIO OF LIVESTOCK RAISED IN THE STUDY AREA THAT IS CONSUMED

For cattle and calves, 10 percent are consumed in the area and 90 percent are exported. For hogs, 15 percent are consumed in the area and 85 percent are exported. For sheep and lambs, 3 percent are consumed in the area and 97 percent are exported. For poultry, there appears to be no commercial poultry producers in this region. The County extension agents believe 100 percent of the chickens and eggs produced in the area are consumed in the area. The statewide average

for poultry and eggs is approximately 50 percent are consumed in the area produced and 50 percent are exported.

OTHER

Other demographic-specific data pertaining to population centers, locations of schools, nursing homes, hospitals, major area employers, and current census information was extracted from the EIS and the Colorado Census Data and was provided under separate cover to the USACHPPM(P).

RECOMMENDATIONS

We recommend the following:

- ◆ Use the data provided in this report and the data provided under separate cover as the basis for completing the SRA for PUDA.
- ◆ If further data specificity is required for these data elements, site visits at PUDA may be required.

Bibliography

- Beasley *et al.*, *Erosion and Sediment Pollution Control*, 2d ed., 1984.
- Colorado Department of Natural Resources, Division of Wildlife, Terrestrial Resource Section, *Colorado Big Game Harvest 1993*, October 1994.
- Colorado Department of Natural Resources, Division of Wildlife, *Economic Impact Model, Tables 1 – 38*, 30 January 1995.
- Colorado Division of Parks and Outdoor Recreation, *Parks Manager Visitation Report With Regional Subtotals, FY94 – FY95*, 1995.
- Geraghty *et al.*, *Water Atlas of the United States*, 1973.
- Halls, Lowell K. *et al.*, *White-Tailed Deer, Ecology and Management*, Wildlife Management Institute, Washington, D.C., 1984.
- U.S. Army Chemical Materiel Destruction Agency, *Disposal of Chemical Agents and Munitions Stored at Pueblo Depot Activity, Preliminary Draft Environmental Impact Statement*, February 1994.
- U.S. Department of Agriculture, Soil Conservation Service, *Soil Survey of Otero County, Colorado*, March 1972.
- U.S. Department of Agriculture, Soil Conservation Service, *Soil Survey of Pueblo Area, Colorado, Parts of Pueblo and Custer Counties*, June 1979.
- U.S. Department of Commerce, Bureau of the Census, *Selected Population and Housing Characteristics, 1990, of Crowley, El Paso, Lincoln, Pueblo, and Otero Counties, Colorado*, July 1991.
- U.S. Department of the Interior, U.S. Geological Survey Water-Data Report CO-93-1, *Water Resources Data Colorado Water Year 1993, Volume 1. Missouri River Basin, Arkansas River Basin, and Rio Grande Basin*, March 1994.
- U.S. Environmental Protection Agency, "Stack Height Regulations," 40:51, *Federal Register*, 1985.
- U.S. Environmental Protection Agency, *Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A)*, Interim Final, EPA/540/1-89/002, Office of Emergency and Remedial Response, 1989.

- U.S. Environmental Protection Agency, *Methodology for Assessing Health Risks Associated with Indirect Exposure to Combustor Emissions*, Interim Final, EPA/600/6-90/003, Office of Health and Environmental Assessment, 1990.
- U.S. Environmental Protection Agency, *Addendum to the Methodology for Assessing Health Risks Associated with Indirect Exposure to Combustor Emissions*, External Review Draft, EPA/600/AP-93/003, Office of Research and Development, 1993.
- U.S. Environmental Protection Agency, *Implementation of Exposure Assessment Guidance for RCRA Hazardous Waste Combustion Facilities*, Memorandum from Jeffery D. Denit, Acting Director, Office of Solid Waste, U.S. Environmental Protection Agency, to Waste Management Division Directors, Regions I-X, 1993.
- U.S. Environmental Protection Agency, *Risk Assessment Implementation Guidance for Performing Screening Level Risk Analyses at Combustion Facilities Burning Hazardous Wastes*, Revised Draft, Office of Emergency and Remedial Response and Office of Solid Waste, April 15, 1994.
- U.S. Environmental Protection Agency, *Risk Assessment Implementation Guidance for Performing Screening Level Risk Analyses at Combustion Facilities Burning Hazardous Wastes*, Errata Sheet, Revised Draft, Office of Emergency and Remedial Response and Office of Solid Waste, August 8, 1994.
- U.S. Environmental Protection Agency, *Derivation of Time Averaged Soil Concentration Equations*, 1994.
- U.S. Environmental Protection Agency, *Estimating Exposure to Dioxin-Like Compounds*, External Review Draft, EPA/600/6-88/005C a – c, Office of Research and Development, 1994.
- U.S. Environmental Protection Agency, *Further Issues for Indirect Exposure Assessment Modeling*, Memorandum from Matthew Lorber, Exposure Assessment Group and Glenn Rice, Indirect Exposure Team, to Addressees, September 1994.
- U.S. Environmental Protection Agency, "Methods Manual for Compliance with the BIF Regulations," 40:266, *Federal Register*, Appendix IX, 1994.

APPENDIX

Data Tables

Tables

A-1. Risk Assessment Information — Pueblo Depot Activity	A-3
(General)	
A-2. Risk Assessment Information — Pueblo Depot Activity	A-4
(Fishing and Hunting)	
A-3. Risk Assessment Information — Pueblo Depot Activity	A-5
(Hunting)	
A-4. Risk Assessment Information — Pueblo Depot Activity	A-6
(Produce)	
A-5. Risk Assessment Information — Pueblo Depot Activity	A-7
(Types of Recreation by County)	
A-6. Risk Assessment Information — Pueblo Depot Activity	A-8
(Soil Data)	
A-7. Risk Assessment Information — Pueblo Depot Activity	A-9
(Plant Tissue)	
A-8. Risk Assessment Information — Pueblo Depot Activity	A-10
(Human Daily Ingestion)	
A-9. Risk Assessment Information — Pueblo Depot Activity	A-11
(Birth Rates and Breast-Feeding)	

Table A-1.***Risk Assessment Information — Pueblo Depot Activity
(General)***

Data elements	Potential data sources	Completed?
<i>Body weight ranges</i> Infants: 1 to 6yrs, 15 kg Adults: 70 kg Babies: < 1yr, <11 kg	<i>Exposure Factors Handbook (EFH)</i> , EPA/600/8-89/043, March 1989, Table 5-2 (adults); Appendix 5A, Tables 5A-3, 4 (averaged 95 percent weight for infants < 1yr.); <i>Human Health Evaluation Manual, Supple- mental Guidance</i> , March 1991, p. 15, Children's weight age 1 to 6 yrs	Yes
<i>Monthly average air temperature, ° F, by month for 10 yrs</i> January: 33.1 February: 34.0 March: 43.1 April: 52.0 May: 61.3 June: 70.8 July: 75.4 August: 73.2 September: 64.4 October: 52.1 November: 37.8 December: 29.5	National Climatic Data Center (NCDC): Noel Risnychok, (704) 271-4800, ext. 163	Yes
<i>Wind information</i> Sustained average wind speed: 10.8 meters per second (m/s) Sustained average wind direc- tion: WNW, W, SSE, N Threshold wind speed: 0.0 m/s	Environmental impact statement (EIS); NCDC information indicates yearly average windspeed of 4.3 m/s from a NW direction. EIS; EPA Risk Guide for Combustors	Yes Yes
<i>Storm information</i> Average rainfall event: 0.031 in./day Maximum rainfall event: 3.77 in./day	NCDC information	Yes

Table A-2.***Risk Assessment Information — Pueblo Depot Activity
(Fishing and Hunting)***

Data elements	Potential data sources	Completed?
<i>Fishing</i> No. of licensed fishermen by co. Length of the fishing season Average no. of fishing days Average catch per fisherman <i>Counties</i> Pueblo El Paso Lincoln Crowley Otero <i>Major fish species</i> Largemouth bass Smallmouth bass Walleye Sauger and hybrids Stripe and hybrid bass Crappie Other sunfish Catfish Suckers Rainbow trout Pikes peak trout	Doug Krieger, (719) 473-2945, Colorado Department of Natural Resources, Division of Wildlife, Fisheries Biologist	Yes

Table A-3.***Risk Assessment Information — Pueblo Depot Activity
(Hunting)***

Data elements	Potential data sources	Completed?
No. of licensed hunters by co.	Colorado Department of Natural Resources, Division of Wildlife, Terrestrial Resource Section, Ann Seiler, (303) 291-7336	Yes
Length of the hunting season by species		
Average no. of hunting days	Mark Elkins — Senior Biologist, (719) 473-2945	
Average harvest by species		
<i>Counties</i>		
Pueblo		
El Paso		
Lincoln		
Crowley		
Otero		
<i>Hunting species</i>		
Mule deer		
Rocky mountain elk		
Pronghorn antelope		
Mountain goat		
Bighorn sheep		
Shiras moose		
Black bear		
Turkey		
Squirrels		
Quail		
Dove		
Band-tailed pigeon		
Grouse		
Ptarmigan		
Pheasant		
Rabbits		
<i>Waterfowl</i>		
Duck		
Goose		
Rails		
Snipe		
Sandhill cranes		
Coots		

Table A-4.***Risk Assessment Information — Pueblo Depot Activity
(Produce)***

Data elements	Potential data source	Completed?
Types of produce grown in home gardens (applies to all Colorado counties in ground dry weight per kilogram body weight per day)	Colorado Agricultural Statistics 1994. State Agricultural Service, (303) 236-2300. <i>EFH</i> Table 2-10, (p. 2-19), values for 50th percentile	Yes
<i>Area produce</i>	<i>Consumption rate in grams/day (g/d)</i>	
Corn	60.90 g/d	
Lima beans	21.80 g/d	
Green beans	15.10 g/d	
Tomatoes	14.60 g/d	
Cucumbers	9.10 g/d	
Grains	2.40 g/d	
Legumes	0.68 g/d	
Potatoes	0.35 g/d	
Root vegetables	0.037 g/d	
Fruits	0.33 g/d	
Fruiting vegetables	0.13 g/d	
Leafy vegetables	0.02 g/d	
	Refer to <i>EFH</i> for child and infant consumption data.	

Table A-5.***Risk Assessment Information — Pueblo Depot Activity
(Types of Recreation by County)***

Data elements	Potential data sources	Completed?
National Park and State Parks of Colorado: three parks in the area of concern with numbers of visitors/year:	Colorado State Parks — Jane Burns, (303) 866-3437	Yes
1. Pueblo State Park — 13,791 acres, 656,961 visitors/year. Activities include camping, fishing, other water sports, hunting, hiking, bicycling, horseback riding, snow skiing, and other winter sports.	National Parks Statistical Information — Ken Hornback, (303) 969-6977	Yes
2. Bent's Old Fort — 799.8 acres, 44,717 visitors/year. Activities include self- and guided tours; picnic facilities. No overnight stays allowed.		
3. Florissant Fossil Beds — 599.8 acres, 100,333 visitors/year. Activities include self- and guided tours, hiking, and cross-country skiing. No overnight stays allowed.		

Table A-6.***Risk Assessment Information — Pueblo Depot Activity
(Soil Data)***

Data elements	Potential data sources	Completed?
<p><i>Soil types</i></p> <p>Provide the average value for all soils in the counties of concern for the following parameters:</p> <p>Moist bulk density (g/cm³) = 1.36</p> <p>Organic contents (percentage) = 1.21</p> <p>Slope length factor (LS) = 0.50</p> <p>Erosion factor (tons/acre) (k) = 0.25</p> <p>Erosivity factor (1/yr) (R) = 70</p> <p><i>Vegetative cover</i></p> <p>The fraction of vegetative cover for each of the following land uses:</p> <p>Total area in 50 Km radius = 7.9E + 9m²</p> <p>Forest, 1.03 percent = 8.14E + 7m²</p> <p>Agriculture, 79.24 percent = 6.26E + 9m²</p> <p>Other, 19.73 percent = 1.56E + 9m²</p> <p><i>Erosion data</i></p> <p>Average annual runoff (cm/yr) = 1.27 cm/yr</p> <p>Soil mixing depth (cm) = 20 cm</p> <p><i>Surface water data</i></p> <p>Water resources in the area: lakes, streams, rivers</p> <p>Surface area of water resources</p> <p>Volumetric flow rates of water resources</p> <p>Depth of water column of water resources</p>	<p>U.S. Geological Survey Soils Books for the counties of concern. Colorado Natural Resources Conservation Service, Allen Price, Soils Scientist, (303) 236-2611.</p> <p>District Conservationist and Soil Project Directors:</p> <p>El Paso Co. — John Valentine, (719) 473-7104</p> <p>Crowley & Otero Co. — Dave Miller, (719) 254-7882</p> <p>Pueblo Co. — Rich Rhoades, (719) 543-8384</p> <p>Lincoln Co. — Bill Hawn, (719) 743-2408</p> <p>Canyon City — Tim Wheeler, (719) 275-9027</p> <p>See EIS, Land Use</p> <p>Gerhaghty <i>et al.</i>, 1973</p> <p>EPA's default for plow depth</p> <p>Provided under separate cover</p> <p>Provided under separate cover</p> <p>Provided under separate cover</p>	<p>Yes</p>

Table A-7.***Risk Assessment Information — Pueblo Depot Activity
(Plant Tissue)***

Data elements	Potential data sources	Completed?
<p>Crop-specific information for each major commercial crop grown in the state. Major crops are corn, wheat, barley, oats, sorghum, and dry beans.</p> <p>Establish the major fruit and vegetable crops (also, see above for common crops)</p> <p><i>Crop productivity</i></p> <p>Bushels/acre</p> <p><i>Harvest yield</i></p> <p>Mass/area</p> <p><i>Area planted to crop acres</i></p> <p>Standing crop biomass kilograms dry weight per meter squared</p> <p><i>Specific information on each crop species</i></p> <p><i>Leafy vegetables</i></p> <p>Height of plant (cm)</p> <p>Radius of plant (cm)</p> <p>Planting practice</p> <p>Plants per row</p> <p>Rows per acre</p> <p>Distance between plants (cm)</p> <p>Distance between rows (cm)</p> <p>Length of growing season (days)</p> <p><i>Round and long produce</i></p> <p>Planting practices</p> <p>Number per unit area (yield)</p> <p>Radius of round produce (cm)</p> <p>Length of long produce (cm)</p> <p>Width of long produce (cm)</p> <p><i>Fruits</i></p> <p>Planting practices</p> <p>Number per unit area (yield)</p> <p>Length and width of long fruit (cm)</p> <p>Radius of round fruit (cm)</p>	<p>Colorado State Department of Agriculture, (303) 239-4100, sending Agricultural Statistics book — this information should be included in the book.</p> <p>The USACHPPM(P) was provided with data compilation from the 1994 <i>Colorado Agricultural Statistics Report</i> and the appropriate EIS section on "Community Resources."</p> <p>The following County Extension Agents were contacted for crop productivity information for their respective counties:</p> <p>for Crowley — Jim Valient: (719) 254-7608</p> <p>for Pueblo — LuAnn Brunetto (719) 543-8386, Charley Hart: (719) 583-6566</p> <p>for Otero — Bill Handcock: (719) 254-7608</p>	Yes

Table A-8.
Risk Assessment Information — Pueblo Depot Activity
(Human Daily Ingestion)

Data elements	Potential data sources	Completed?
<p><i>Crops</i></p> <p>Segregated as shown below for each commercially grown crop</p> <p>Leafy vegetables</p> <p>Above-ground protected produce</p> <p>Above-ground exposed round produce</p> <p>Above-ground exposed long produce</p> <p>Below-ground produce</p> <p><i>Animal products</i></p> <p>These are the major commercial animal products produced in Colorado:</p> <p>Cattle and calves</p> <p>Hogs</p> <p>Sheep and lambs</p> <p>Poultry and eggs</p> <p><i>Animals that are hunted</i></p> <p>Mule deer</p> <p>Rocky mountain elk</p> <p>Pronghorn antelope</p> <p>Mountain goat</p> <p>Bighorn sheep</p> <p>Shiras moose</p> <p>Black bear</p> <p>Turkey</p> <p>Squirrels</p> <p>Quail</p> <p>Dove</p> <p>Band-tailed pigeon</p> <p>Grouse</p> <p>Ptarmigan</p> <p>Pheasant</p> <p>Rabbits</p> <p><i>Waterfowl</i></p> <p>Duck</p> <p>Goose</p> <p>Rails</p> <p>Snipe</p> <p>Sanhill cranes</p> <p>Coots</p>	<p>See <i>EFH</i> it provides information on percentage of crops that people eat that they grow. Recommend use of exposure factors from the <i>EFH</i> on amounts of each meat and vegetable consumed. Use the appropriate screening-level risk analysis formulas to calculate the amount of contaminant ingested.</p> <p>Again, County Extension Agent/Services were contacted and asked the following questions:</p> <p>a. How much of each animal produce is raised in the county?</p> <p>b. Of the amount raised in the county, how much is consumed within the county?</p> <p>c. How much of that raised is exported and to where is it exported?</p> <p>Similar questions were asked for each major crop produced in the county.</p>	<p>Yes</p>

Table A-9.***Risk Assessment Information — Pueblo Depot Activity
Birth Rates and Breast-Feeding)***

Data elements			Potential data sources	Completed?
Breast milk — percentage of infants that are breast-fed			Colorado Vital Statistics — Department of Health. Birth rate info (Juanita) (303) 692-2160	Yes
Birth rate				
<i>1993 Data</i>	<i>Avg. births/yr</i>	<i>Birth rate percentage</i>		
Pueblo	1767	14.1		
El Paso	7407	17.1		
Lincoln	54	8.9		
Crowley	37	9.0		
Otero	325	15.7		

REPORT DOCUMENTATION PAGE

Form Approved
OPM No.0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources gathering, and maintaining the data needed, and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503.

1. AGENCY USE ONLY (Leave Blank)		2. REPORT DATE Aug 95	3. REPORT TYPE AND DATES COVERED Final
4. TITLE AND SUBTITLE Data Supporting the Screening Risk Assessment for the Pueblo Depot Activity Chemical Demilitarization Facility			5. FUNDING NUMBERS DACW31-94-D-0092 PE 0902198D
6. AUTHOR(S) William E. Legg			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Logistics Management Institute 2000 Corporate Ridge McLean, VA 22102-7805			8. PERFORMING ORGANIZATION REPORT NUMBER LMI- CE417RD3
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) LTC Richard L. Kussman Director, Environmental Health Engineering Directorate U.S. Army Center for Health Promotion and Preventive Medicine (Provisional) Aberdeen Proving Ground, MD 21010-5422			10. SPONSORING/MONITORING AGENCY REPORT NUMBER
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION/AVAILABILITY STATEMENT A: Approved for public release; distribution unlimited			12b. DISTRIBUTION CODE
13. ABSTRACT (Maximum 200 words) <p>In 1986, the Department of Defense Authorization Act directed the destruction of the chemical agent stockpiles by 30 September 1994. This act was amended in 1988 to allow for operational testing of a commercial-scale incineration project, and the date for complete destruction of the stockpiles was extended to September 1997. Based upon the results of an environmental impact statement, the chemical agent disposal method that appeared to provide the highest degree of safety to human health and the environment was on-site high temperature incineration. The chemical agent demilitarization program initiated design of the incineration facilities and preparation of the required Resource Conservation and Recovery Act, Part B, permits for hazardous waste incinerators.</p> <p>In 1993, the U.S. Army Center for Health Promotion and Preventive Medicine (Provisional) was tasked by the U.S. Army Chemical Demilitarization and Remediation Activity to perform multipathway human health risk assessments and ecological risk assessments for the eight sites that store unitary chemical agents. The Logistics Management Institute (LMI) was requested to develop the screening-level risk analysis data requirements for the Pueblo Depot Activity (PUDA), Pueblo, Colorado, proposed site. The data analyzed and/or derived for the PUDA screening-level risk assessment included: demographic data for all counties in the study area; hydrologic data for all major bodies of water in the study area; analyses of soils' chemical and physical parameters; analyses of 10 years worth of meteorological data; and development of site-specific exposures assessment parameters for the study area. It was recommended that the data derived by LMI be used in place of the Environmental Protection Agency's default data parameters for many of the exposure values.</p>			
14. SUBJECT TERMS Combustor; screening risk assessment; exposure assessment; carcinogenic risk; noncancer hazard quotient; chronic daily intake; cancer slope factor; reference dose/concentration			15. NUMBER OF PAGES 38
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL